FIG.1

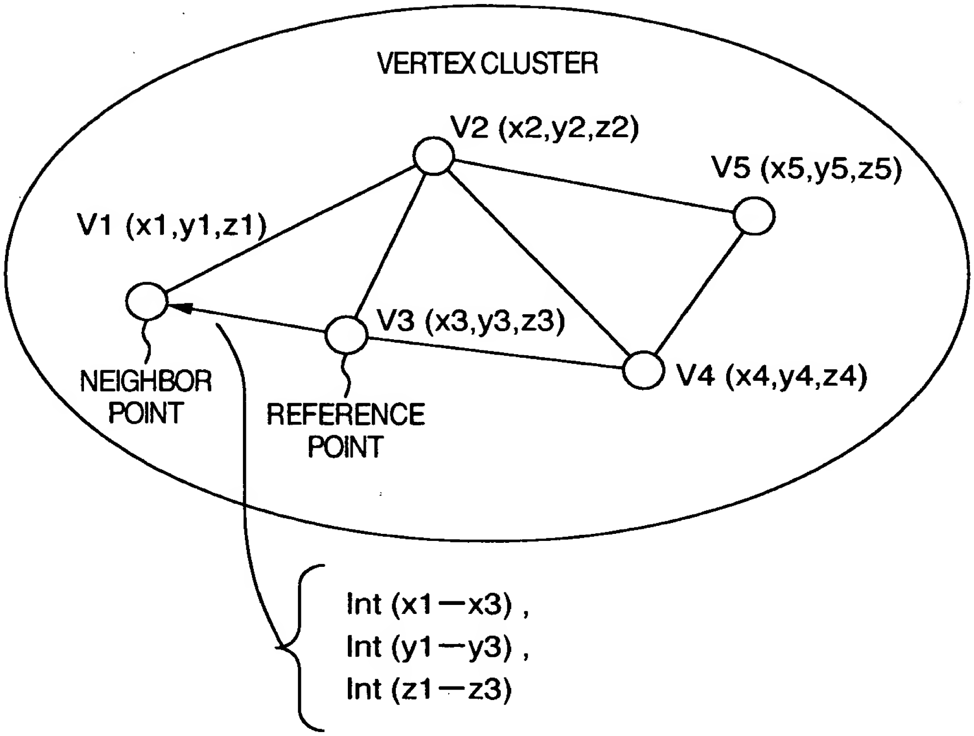

VERTEX CLUSTER
V2 (x2,y2,z2)
V5 (x5,y5,z5)
V1 (x1,y1,z1)
V3 (x3,y3,z3)
V4 (x4,y4,z4)
NEIGHBOR POINT
REFERENCE POINT
Int (x1−x3) ,
Int (y1−y3) ,
Int (z1−z3)

FIG.2A

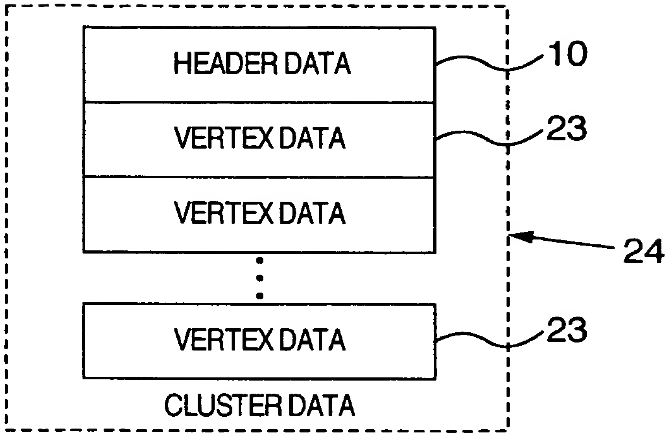


FIG.2B

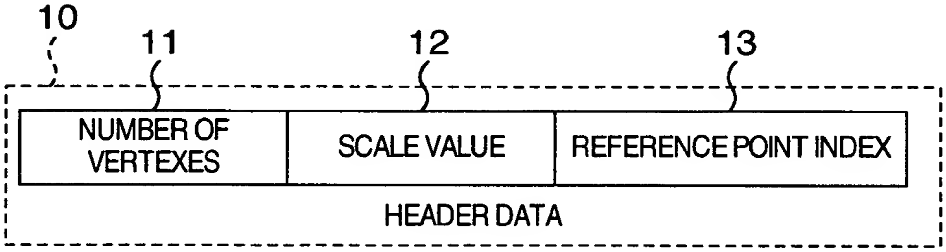


FIG.2C

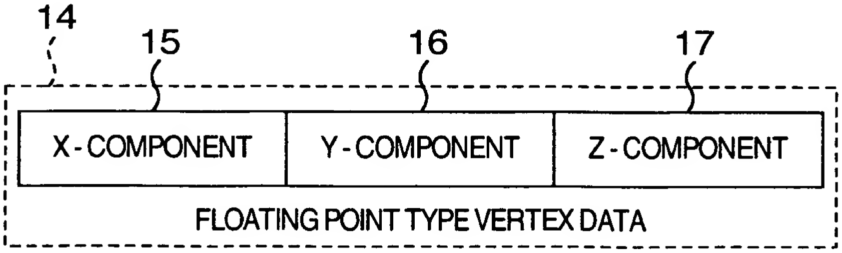


FIG.2D

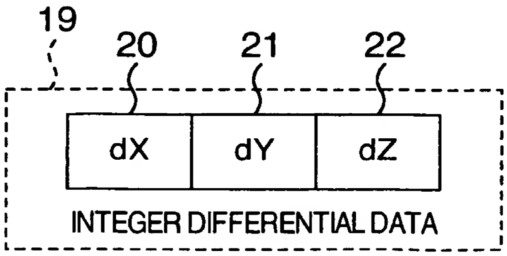


FIG.3A

INTEGER DIFFERENTIAL EXPRESSION OF IN-CLUSTER COORDINATES
(REFERENCE POINT=V3)

VERTEX	X-COMPONENT	Y-COMPONENT	Z-COMPONENT
V1	Int (x1-x3)	Int (y1-y3)	Int (z1-z3)
V2	Int (x2-x3)	Int (y2-y3)	Int (z2-z3)
V3	x3	y3	z3
V4	Int (x4-x3)	Int (y4-y3)	Int (z4-z3)
V5	Int (x5-x3)	Int (y5-y3)	Int (z5-z3)

FIG.3B

FLOATING POINT DIFFERENTIAL EXPRESSION OF IN-CLUSTER COORDINATES
(REFERENCE POINT=V3)

VERTEX	X-COMPONENT	Y-COMPONENT	Z-COMPONENT
V1	x1-x3	y1-y3	z1-z3
V2	x2-x3	y2-y3	z2-z3
V3	x3	y3	z3
V4	x4-x3	y4-y3	z4-z3
V5	x5-x3	y5-y3	z5-z3

FIG.4

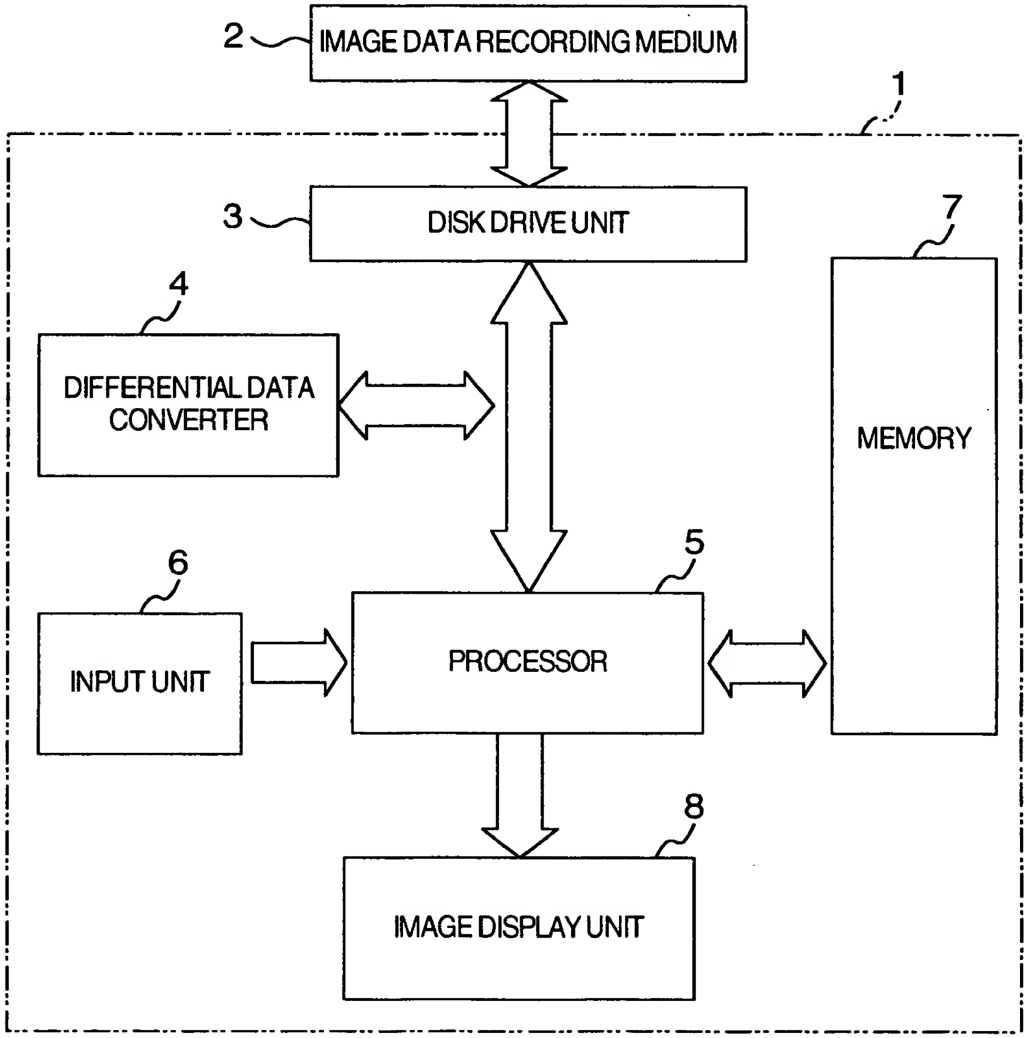

2
IMAGE DATA RECORDING MEDIUM
1
3
DISK DRIVE UNIT
7
4
DIFFERENTIAL DATA CONVERTER
MEMORY
5
6
INPUT UNIT
PROCESSOR
8
IMAGE DISPLAY UNIT

FIG.5

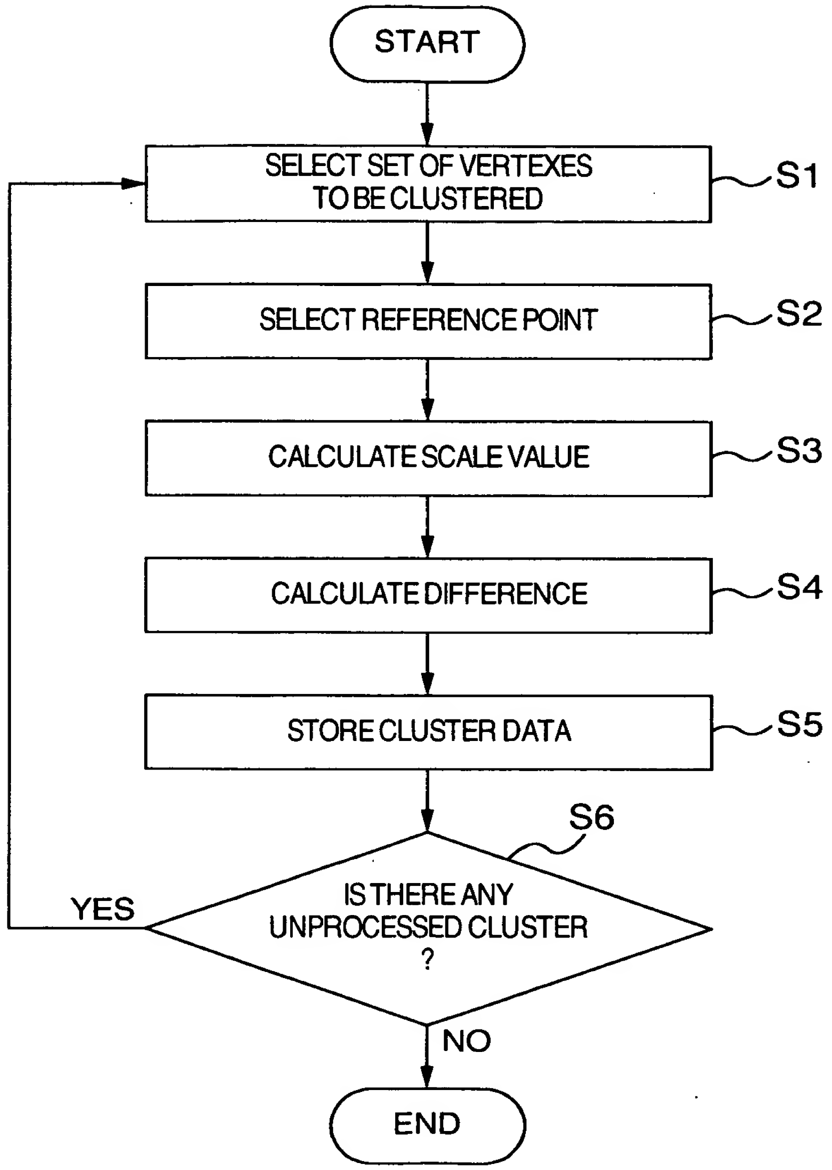

START
SELECT SET OF VERTEXES TO BE CLUSTERED
S1
SELECT REFERENCE POINT
S2
CALCULATE SCALE VALUE
S3
CALCULATE DIFFERENCE
S4
STORE CLUSTER DATA
S5
S6
IS THERE ANY UNPROCESSED CLUSTER ?
YES
NO
END

FIG.6A

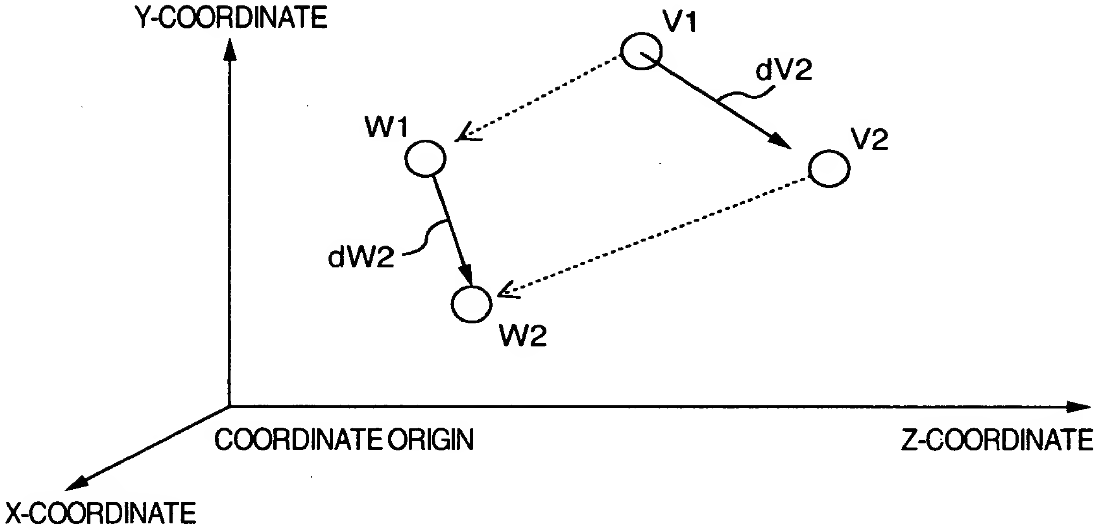


FIG.6B

AFFINE TRANSFORMATION : $W = M^{*} V + P$ · · · EXPRESSION (1)

$$\begin{pmatrix} tx \\ ty \\ tz \end{pmatrix} = \begin{pmatrix} m11 & m12 & m13 \\ m21 & m22 & m23 \\ m31 & m32 & m33 \end{pmatrix} \begin{pmatrix} x \\ y \\ z \end{pmatrix} + \begin{pmatrix} p \\ q \\ r \end{pmatrix} \quad \cdots \text{EXPRESSION (2)}$$

FIG.7A

COORDINATE DIFFERENTIAL EXPRESSION
BEFORE AFFINE TRANSFORMATION
(REFERENCE POINT=V1)

VERTEX	X - COMPONENT	Y - COMPONENT	Z - COMPONENT
V1	X - COMPONENT OF V1	Y - COMPONENT OF V1	Z - COMPONENT OF V1
V2	X - COMPONENT OF dV2	Y- COMPONENT OF dV2	Z- COMPONENT OF dV2

FIG.7B

COORDINATE DIFFERENTIAL EXPRESSION
AFTER AFFINE TRANSFORMATION
(REFERENCE POINT=W1)

VERTEX	X - COMPONENT	Y - COMPONENT	Z - COMPONENT
W1	X - COMPONENT OF M^{*} V1+P	Y- COMPONENT OF M^{*} V1+P	Z - COMPONENT OF M^{*} V1+P
W2	X - COMPONENT OF M^{*} dV2	Y - COMPONENT OF M^{*} dV2	Z- COMPONENT OF M^{*} dV2

FIG.8A

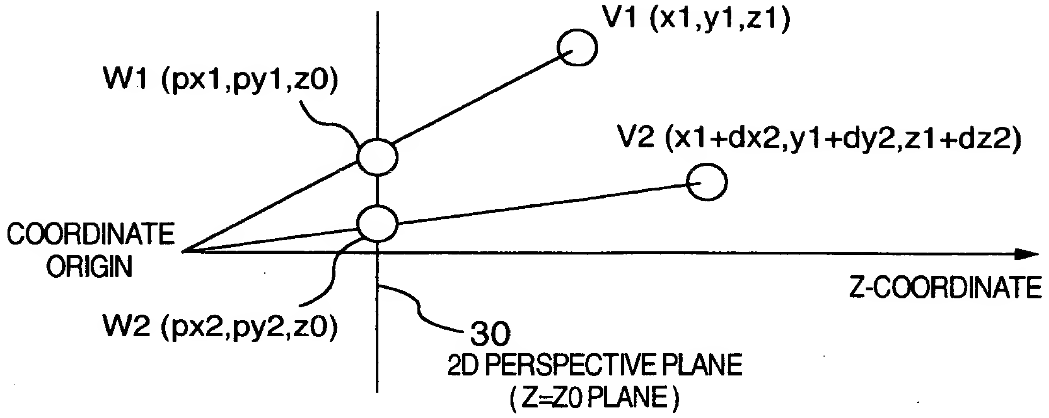


FIG.8B

$A=z0/z1$	EXPRESSION 1
$B=z0/(z1*z1)$	EXPRESSION 2
$px1=A*x1$	EXPRESSION 3
$py1=A*y1$	EXPRESSION 4
$px2=(A-B*dz2)*(x1+dx2)$	EXPRESSION 5
$py2=(A-B*dz2)*(x1+dy2)$	EXPRESSION 6
$D=z0/(z1+dz)$	EXPRESSION 7
$px=D*(x1+dx)$	EXPRESSION 8
$py=D*(y1+dy)$	EXPRESSION 9
$\frac{1}{z+dz}=\frac{1}{z}-\frac{1}{z^2}dz+\frac{1}{z^3}dz^2-\frac{1}{z^4}dz^3+\cdots$	EXPRESSION 10
$\frac{z0}{z1+dz2}=\frac{z0}{z1}-\frac{z0}{z1^2}*dz2$	EXPRESSION 11

FIG.9

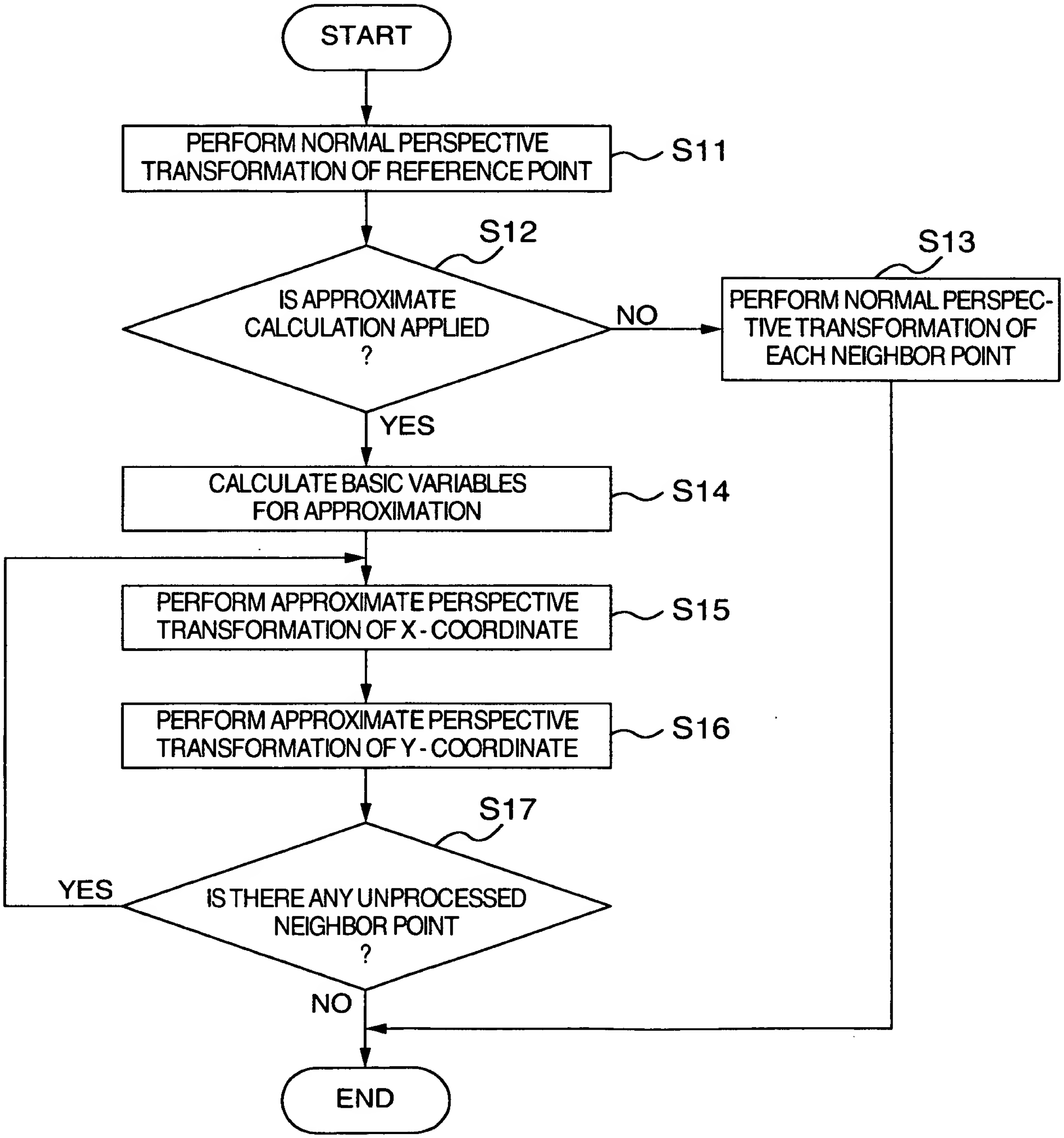

START
PERFORM NORMAL PERSPECTIVE TRANSFORMATION OF REFERENCE POINT
S11
S12
IS APPROXIMATE CALCULATION APPLIED ?
NO
S13
PERFORM NORMAL PERSPECTIVE TRANSFORMATION OF EACH NEIGHBOR POINT
YES
CALCULATE BASIC VARIABLES FOR APPROXIMATION
S14
PERFORM APPROXIMATE PERSPECTIVE TRANSFORMATION OF X - COORDINATE
S15
PERFORM APPROXIMATE PERSPECTIVE TRANSFORMATION OF Y - COORDINATE
S16
S17
YES
IS THERE ANY UNPROCESSED NEIGHBOR POINT ?
NO
END

FIG.10A

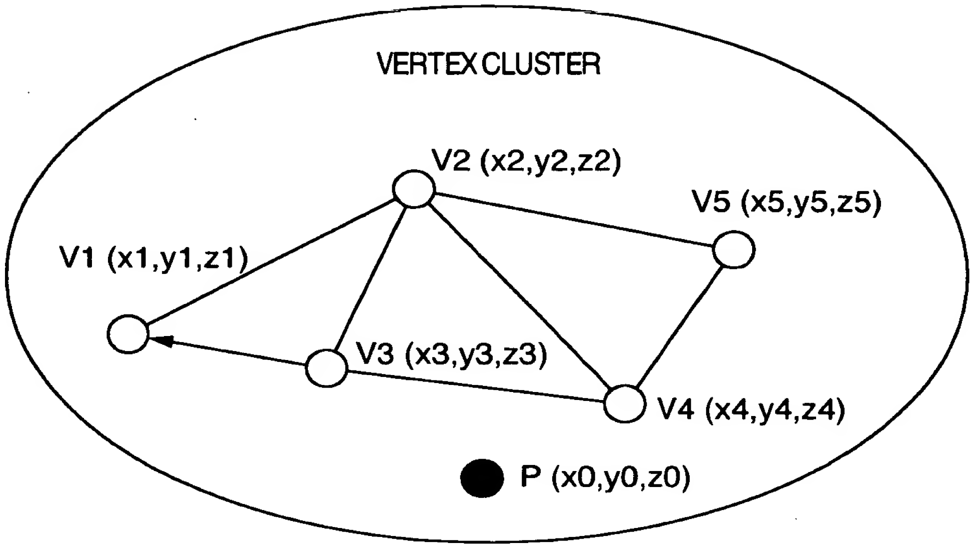


FIG.10B

INTEGER DIFFERENTIAL EXPRESSION OF IN-CLUSTER COORDINATES
(REFERENCE POINT=P)

VERTEX	X-COMPONENT	Y-COMPONENT	Z-COMPONENT
V1	Int (x1-x0)	Int (y1-y0)	Int (z1-z0)
V2	Int (x2-x0)	Int (y2-y0)	Int (z2-z0)
V3	Int (x3-x0)	Int (y3-y0)	Int (z3-z0)
V4	Int (x4-x0)	Int (y4-y0)	Int (z4-z0)
V5	Int (x5-x0)	Int (y5-y0)	Int (z5-z0)

FIG.11

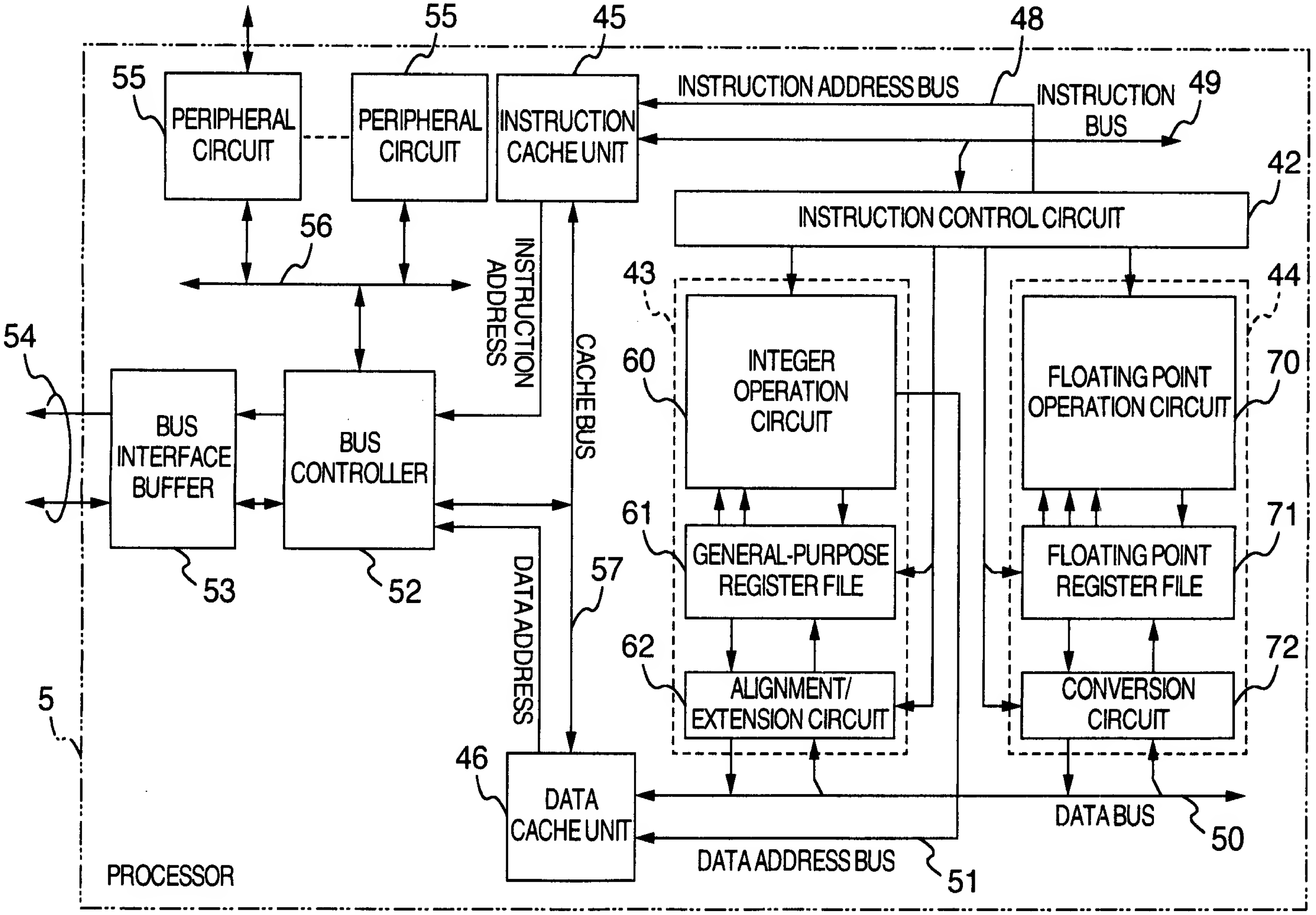
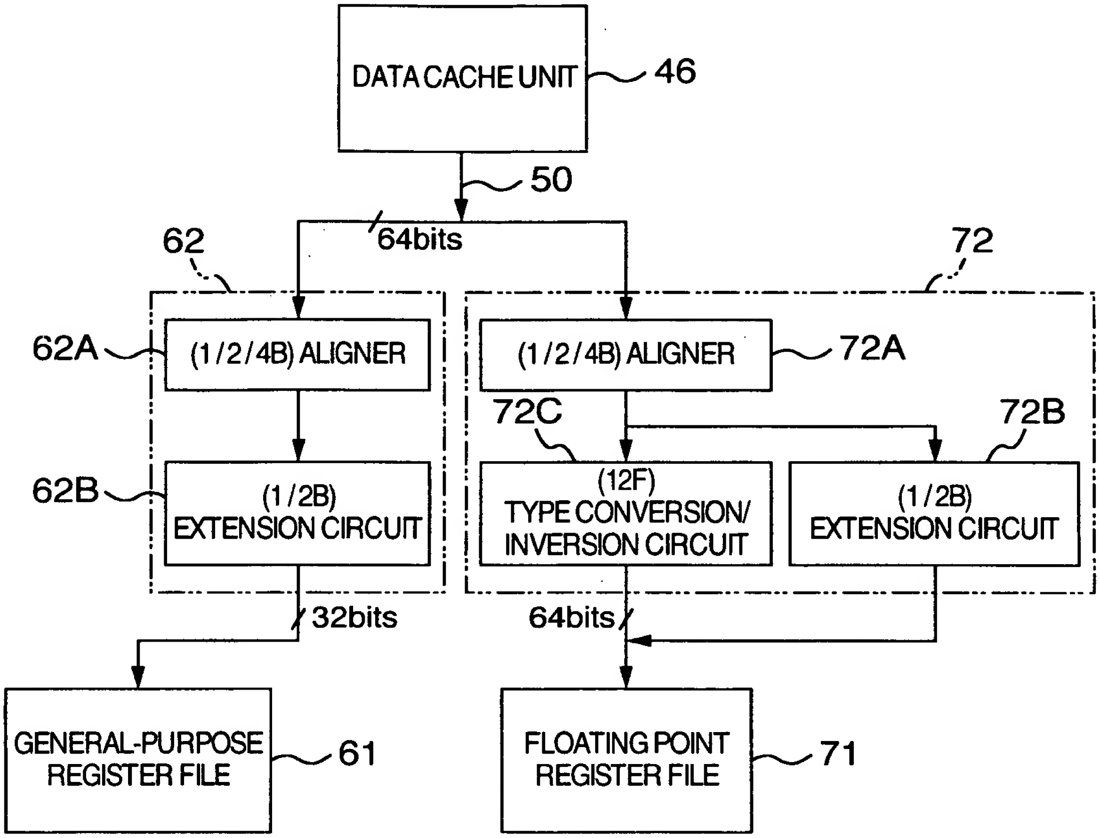
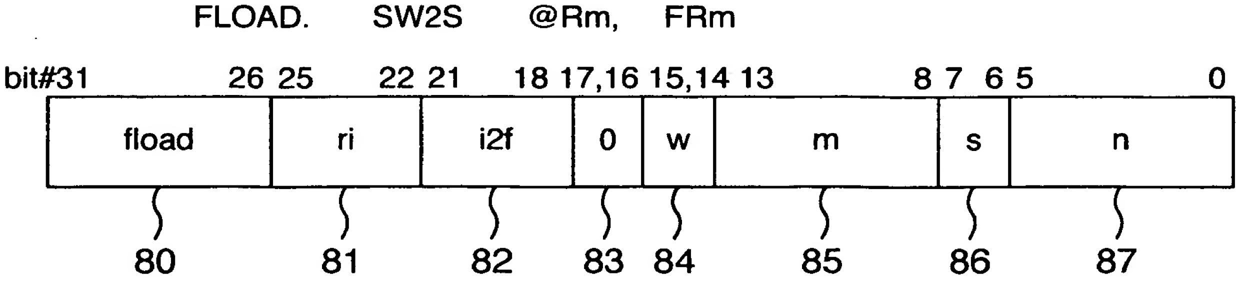

55
PERIPHERAL CIRCUIT
55
PERIPHERAL CIRCUIT
45
INSTRUCTION CACHE UNIT
48
INSTRUCTION ADDRESS BUS
INSTRUCTION BUS
49
42
INSTRUCTION CONTROL CIRCUIT
56
INSTRUCTION ADDRESS
CACHE BUS
43
44
54
60
INTEGER OPERATION CIRCUIT
FLOATING POINT OPERATION CIRCUIT
70
BUS INTERFACE BUFFER
BUS CONTROLLER
61
GENERAL-PURPOSE REGISTER FILE
FLOATING POINT REGISTER FILE
71
53
52
57
DATA ADDRESS
62
ALIGNMENT/ EXTENSION CIRCUIT
CONVERSION CIRCUIT
72
5
46
DATA CACHE UNIT
DATA BUS
50
PROCESSOR
DATA ADDRESS BUS
51

FIG.12



DATA CACHE UNIT
46
50
64bits
62
72
62A
(1/2/4B) ALIGNER
(1/2/4B) ALIGNER
72A
72C
72B
62B
(1/2B) EXTENSION CIRCUIT
(12F) TYPE CONVERSION/ INVERSION CIRCUIT
(1/2B) EXTENSION CIRCUIT
32bits
64bits
GENERAL-PURPOSE REGISTER FILE
61
FLOATING POINT REGISTER FILE
71

FIG.13



FLOAD. SW2S @Rm, FRm
bit#31
26 25
22 21
18 17,16 15,14 13
8 7 6 5
0
fload
ri
i2f
0
w
m
s
n
80
81
82
83
84
85
86
87

FIG.14

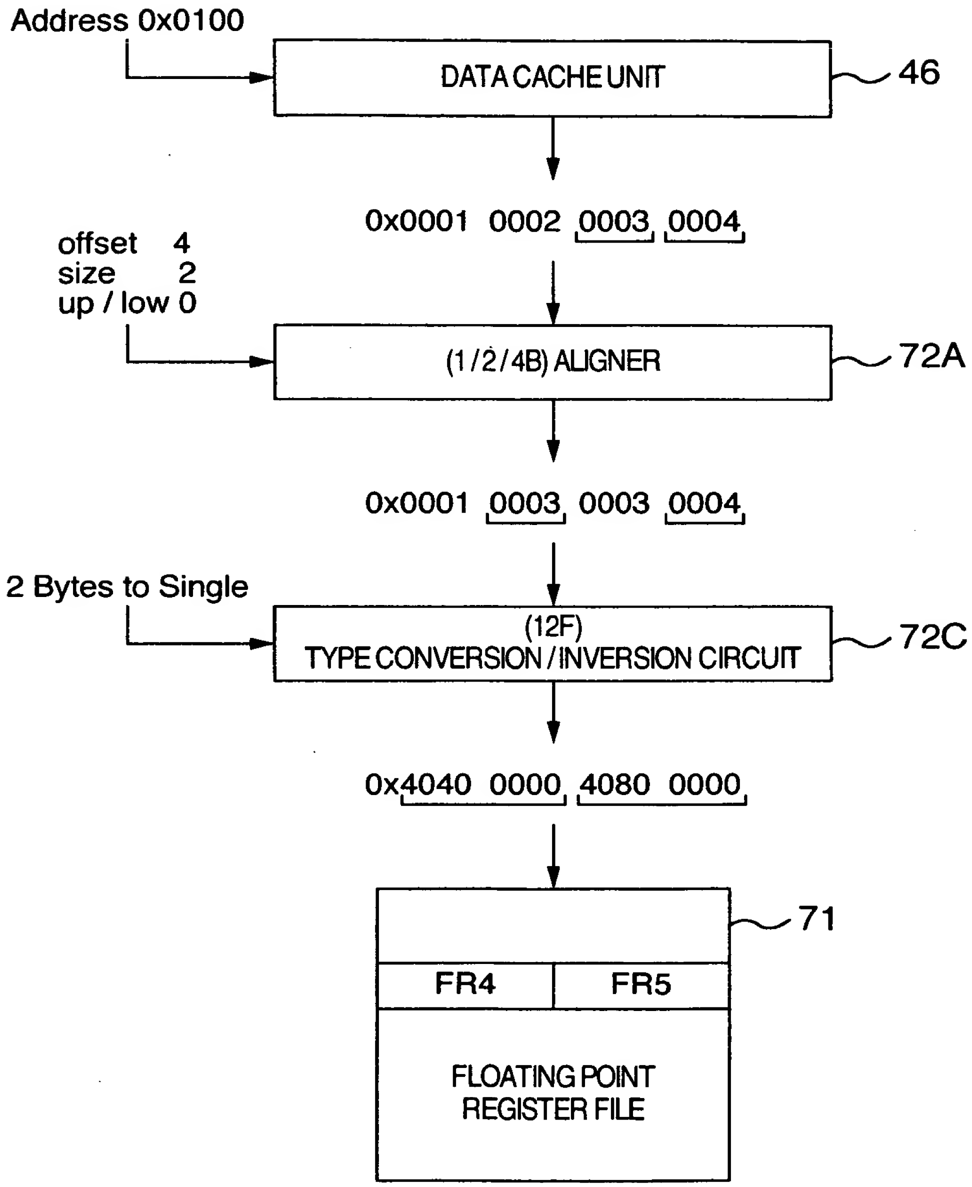
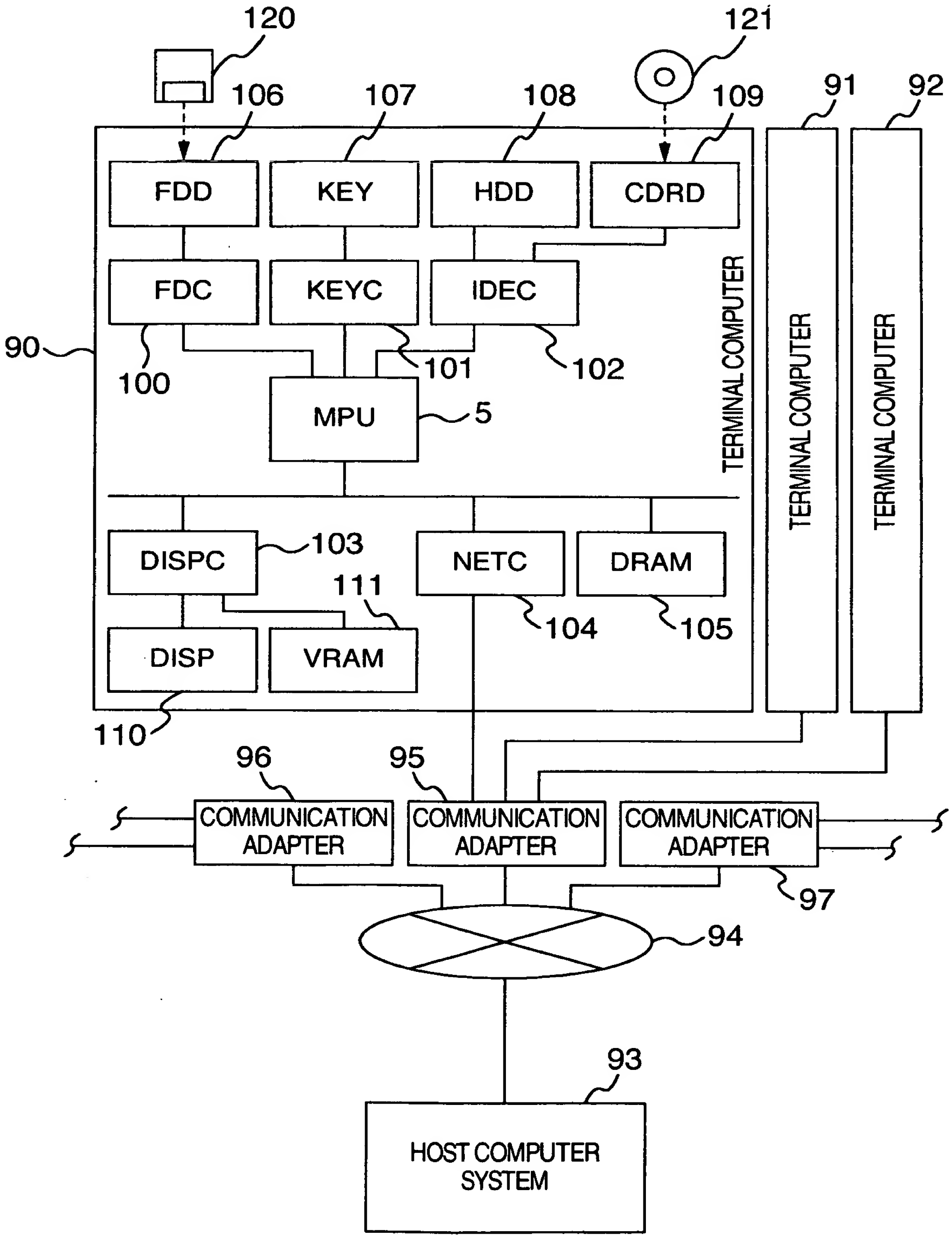

Address 0x0100
DATA CACHE UNIT
46
0x0001 0002 0003 0004
offset 4
size 2
up / low 0
(1/2/4B) ALIGNER
72A
0x0001 0003 0003 0004
2 Bytes to Single
(12F)
TYPE CONVERSION / INVERSION CIRCUIT
72C
0x4040 0000 4080 0000
71
FR4
FR5
FLOATING POINT
REGISTER FILE

FIG.15


120
121
106
107
108
109
91
92
FDD
KEY
HDD
CDRD
FDC
KEYC
IDEC
TERMINAL COMPUTER
TERMINAL COMPUTER
TERMINAL COMPUTER
90
100
101
102
MPU
5
DISPC
103
NETC
DRAM
111
DISP
VRAM
104
105
110
96
95
COMMUNICATION ADAPTER
COMMUNICATION ADAPTER
COMMUNICATION ADAPTER
97
94
93
HOST COMPUTER SYSTEM